

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (canceled)

1 Claim 2 (previously presented): The method of claim 11
2 wherein the path is a label-switched path.

1 Claim 3 (previously presented): The method of claim 11
2 wherein the message is a resource reservation protocol PATH
3 message.

Claim 4 (canceled)

1 Claim 5 (currently amended): A method for processing, by a
2 node of a network, a message from another node of the
3 network, the message carrying at least one network path
4 determination constraint, the method comprising:
5 a) performing a constraint-based path determination
6 to a next node to generate a partial path; and
7 b) forwarding the message carrying the at least one
8 network path determination constraint to an adjacent
9 downstream node on the partial path,
10 wherein the at least one network path
11 determination constraint is expressed in the form of a
12 program including one or more executable instructions.

1 Claim 6 (currently amended): A network node comprising:
2 a) a path determination facility for performing a
3 constraint-based path determination to a next node to
4 generate a partial path; and
5 b) a signaling facility for

6 i) receiving a message from another node of the
7 network, the message carrying at least one
8 network path determination constraint, and
9 ii) forwarding the message carrying the at least
10 one network path determination constraint to an
11 adjacent downstream node on the partial path,
12 wherein the at least one network path
13 determination constraint is expressed in the form of a
14 program including one or more executable instructions.

Claim 7 (canceled).

1 Claim 8 (previously presented): The method of claim 11
2 wherein the at least one network path determination
3 constraint includes a list of at least one explicit node
4 specified to be a part of the path.

1 Claim 9 (original): The method of claim 8 wherein the list
2 of at least one explicit node specified to be a part of the
3 path identifies at least one of a strict-hop node and a
4 loose-hop node.

1 Claim 10 (original): The method of claim 8 wherein the
2 message forwarded to the adjacent downstream node on the
3 partial path includes an updated list, and
4 wherein the node maintains the initial instance
5 of the list, as received.

1 Claim 11 (currently amended): A method for processing, by
2 a node of a network, a message from another node of the
3 network, the message carrying at least one network path
4 determination constraint, the method comprising:

5 a) performing a constraint-based path determination
6 to a next node selected from a group of nodes
7 consisting of
8 (i) an area border node,
9 (ii) an autonomous system gateway node,
10 (iii) a node that can process one of the at least
11 one network path determination constraint carried
12 by the message which the present node cannot, or
13 will not, evaluate,
14 (iv) a specified loose-hop node, and
15 (v) a node to which constraint processing is
16 delegated,
17 to generate a partial path; and
18 b) forwarding the message carrying the at least one
19 network path determination constraint to an adjacent
20 downstream node on the partial path, or to a delegated
21 node that is able to carry out the path determination,
22 wherein the at least one network path determination
23 constraint is expressed in the form of a program including
24 one or more executable instructions.

1 Claim 12 (original): The method of claim 11 wherein each
2 executable instruction includes:

- 3 - information about a first operand;
4 - information about a second operand; and
5 - an operation code.

1 Claim 13 (original): The method of claim 12 wherein the
2 operation code identifies an operation selected from a
3 group of operations consisting of:

- 4 - bit-wise AND;
5 - bit-wise OR;

- 6 - bit-wise XOR;
- 7 - bit-wise equality;
- 8 - bit-wise inversion;
- 9 - Boolean AND;
- 10 - Boolean OR; and
- 11 - Boolean negation.

1 Claim 14 (original): The method of claim 12 wherein the
2 information about either of the first operand or the second
3 operand is a pointer to a register.

1 Claim 15 (original): The method of claim 14 wherein the
2 register is a register which contains a link attribute.

1 Claim 16 (original): The method of claim 14 wherein the
2 register is a read-only register.

1 Claim 17 (previously presented): The method of claim 11
2 further comprising:
3 - generating a list which specifies nodes on the
4 partial path as strict hop nodes; and
5 - forwarding the list to an adjacent downstream node
6 on the partial path.

1 Claim 18 (original): A method for processing, by a node of
2 a network, a message carrying at least one network path
3 determination constraint, the method comprising:
4 a) determining whether the node is a tail-end node, a
5 head-end node, or an intermediate node of the path;
6 b) if it is determined that the node is a tail-end
7 node and each of the at least one network path
8 determination constraint has been satisfied, then

9 signaling back to an upstream node of the path that
10 the path is OK;
11 c) if it is determined that the node is one of a
12 head-end node and an intermediate node, then
13 i) determining whether (a) a strict-hop node is
14 specified as a next node of an explicit path
15 constraint, (b) a loose-hop node is specified as
16 a next node of an explicit path constraint, or
17 (c) no node is specified as an explicit path
18 constraint,
19 ii) if a strict-hop node is specified as a next
20 node of an explicit path constraint, then
21 A) applying each of the at least one
22 network path determination constraint to an
23 appropriate one of a link between the node
24 and the strict-hop node, the strict-hop
25 node, and the partial path defined,
26 B) if each of the at least one constraint
27 is satisfied, then forwarding a message
28 carrying the at least one network path
29 determination constraint to the strict-hop
30 node, and
31 C) if any one of the at least one
32 constraint was not satisfied, then signaling
33 a path error back to an upstream node,
34 iii) if one of (a) a loose hop node is specified
35 as a next node of an explicit path constraint or
36 (b) no node is specified as an explicit path
37 constraint, then
38 A) performing a constraint-based path
39 determination to a next node selected from a
40 group of nodes consisting of

41 (1) an area border node,
42 (2) an autonomous system gateway node,
43 (3) a node that can process one of the
44 at least one network path determination
45 constraint carried by the message which
46 the present node cannot, or is
47 unwilling to, evaluate,
48 (4) a specified loose-hop node, and
49 (5) a node to which constraint
50 processing is delegated,
51 to generate a partial path, and
52 B) forwarding the message carrying the at
53 least one network path determination
54 constraint to an adjacent downstream
55 node on the partial path.

1 Claim 19 (original): The method of claim 18 wherein the
2 upstream node is the head-end node.

1 Claim 20 (currently amended): A computer-readable
2 ~~machine-readable~~ medium having stored thereon at least one
3 network path determination constraint expressed as an
4 executable instruction, each executable instruction
5 comprising:
6 - information concerning a first operand;
7 - information concerning a second operand; and
8 - an operation code,
9 wherein the machine-readable medium is a
10 component of a first node of a communications network, and
11 wherein the at least one network path
12 determination constraint is expressed as an executable
13 program including one or more instructions, and wherein the

14 executable program was received in a message from a second
15 node of the communications network.

1 Claim 21 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 20 wherein the operation
3 code denotes an operation selected from a group of
4 operations consisting of:

- 5 - bit-wise AND;
- 6 - bit-wise OR;
- 7 - bit-wise XOR;
- 8 - bit-wise equality;
- 9 - bit-wise inversion;
- 10 - Boolean AND;
- 11 - Boolean OR; and
- 12 - Boolean negation.

1 Claim 22 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 20 wherein the information
3 concerning either of the first operand or the second
4 operand is a pointer to a register.

1 Claim 23 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 22 wherein the register is
3 a register that contains a link attribute.

1 Claim 24 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 22 wherein the link
3 attribute is selected from a group of link attributes
4 consisting of:

- 5 - link type;
- 6 - maximum link bandwidth;
- 7 - maximum reservable link bandwidth;

- 8 - current bandwidth reservation;
- 9 - current bandwidth usage;
- 10 - link coloring;
- 11 - link administrative group;
- 12 - link delay;
- 13 - link media type;
- 14 - optical link wavelength;
- 15 - optical link minimum signal to noise ratio;
- 16 - optical link maximum power dispersion;
- 17 - optical link transmission power; and
- 18 - optical link receiver sensitivity.

1 Claim 25 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 22 wherein the register is
3 a register that contains a node attribute.

1 Claim 26 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 25 wherein the node
3 attribute is selected from a group of node attributes
4 consisting of:
5 - node type;
6 - minimum node throughput;
7 - node quality of service support; and
8 - node queuing type.

1 Claim 27 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 20 having further stored
3 thereon at least one network path determination constraint
4 as a list of at least one explicit node that is specified
5 to be a part of the network path.

1 Claim 28 (currently amended): The computer-readable
2 ~~machine-readable~~ medium of claim 27 wherein the at least
3 one explicit node is one of a loose-hop node and a
4 strict-hop node.

1 Claim 29 (previously presented): A network node
2 comprising:
3 a) a plurality of registers including attribute
4 registers, the attribute registers storing attributes
5 of links in the network; and
6 b) a machine-readable medium having stored thereon
7 at least one network path determination constraint as
8 an instruction, each executable instruction including
9 i) a first operand pointer,
10 ii) a second operand pointer, and
11 iii) an operation code,
12 wherein at least one of the first and second
13 operand pointers points to one of the attribute
14 registers, and
15 wherein the executable instruction was
16 received in a message from another network node.

1 Claim 30 (original): The network node of claim 29 wherein
2 the plurality of registers further includes general purpose
3 registers,
4 wherein each of the attribute registers is a
5 read-only register, and
6 wherein each of the general purpose registers is
7 read/write register.

1 Claim 31 (original): The network node of claim 29 wherein
2 the machine-readable medium also has stored thereon at

3 least one network path determination constraint as a list
4 of at least one explicit node that is specified to be a
5 part of the network path.

1 Claim 32 (original): The network node of claim 31 wherein
2 the at least one explicitly specified node is one of a
3 loose-hop node and a strict-hop node.

1 Claim 33 (original): The network node of claim 29 wherein
2 the plurality of registers further include accumulation
3 registers storing cumulative attributes of a path.

1 Claim 34 (previously presented): A computer-readable
2 storage medium having stored thereon a message to be
3 communicated between different network nodes in a
4 communications network, the message comprising:
5 a) a program including one or more executable
6 instructions, each executable instruction encoding at
7 least one network path determination constraint; and
8 b) a list of at least one explicit node specified to
9 be a part of the path.

1 Claim 35 (previously presented): The computer-readable
2 storage medium of claim 34 wherein the executable
3 instruction includes:
4 - information concerning a first operand;
5 - information concerning a second operand; and
6 - an operation code.

1 Claim 36 (original): A method for processing, by a node of
2 a network, a message carrying at least one network path
3 determination constraint, the method comprising:

4 a) if the tail-end node of the path is in a part of
5 the network, the topology of which is not known by the
6 node, then performing a constraint-based path
7 determination to a next node selected from a group of
8 nodes consisting of
9 (i) an area border node, and
10 (ii) an autonomous system gateway node,
11 to generate a partial path; and
12 b) forwarding the message carrying the at least one
13 network path determination constraint to an adjacent
14 downstream node on the partial path.

1 Claim 37 (currently amended): A method for processing, by
2 a node of a network, a message from another node of the
3 network, the message carrying at least one network path
4 determination constraint, the method comprising:
5 a) if a next node specified in a list of explicit
6 nodes is a loose-hop node, then performing a
7 constraint-based path determination to the next
8 loose-hop node to generate a partial path; and
9 b) forwarding the message carrying the at least one
10 network path determination constraint to an adjacent
11 downstream node on the partial path,
12 wherein the at least one network path
13 determination constraint is expressed in the form of a
14 program including one or more executable instructions.

1 Claim 38 (currently amended): A method for processing, by
2 a node of a network, a message from another node of the
3 network, the message carrying at least one network path
4 determination constraint, the method comprising:

5 a) if the node cannot process any one of the at least
6 one network path determination constraint, performing
7 a constraint-based path determination to a node that
8 can process that one of the at least one network path
9 determination constraint, to generate a partial path;
10 and
11 b) forwarding the message carrying the at least one
12 network path determination constraint to an adjacent
13 downstream node on the partial path,
14 wherein the at least one network path
15 determination constraint is expressed in the form of a
16 program including one or more executable instructions.

1 Claim 39 (currently amended): A method for processing, by
2 a node of a network, a message from another node of the
3 network, the message carrying at least one network path
4 determination constraint, the method comprising:
5 a) if constraint processing has been delegated to
6 another network element, performing a constraint-based
7 path determination to the other network element to
8 which constraint processing has been delegated to
9 generate a partial path; and
10 b) forwarding the message carrying the at least one
11 network path determination constraint to an adjacent
12 downstream node on the partial path,
13 wherein the at least one network path
14 determination constraint is expressed in the form of a
15 program including one or more executable instructions.

1 Claim 40 (previously presented): A network node
2 comprising:

- 3 a) a path determination facility for performing a
4 constraint-based path determination to a next node
5 to generate a partial path;
6 b) a signaling facility for
7 i) receiving a message carrying at least one
8 network path determination constraint, and
9 ii) forwarding the message carrying the at
10 least one network path determination constraint
11 to an adjacent downstream node on the partial
12 path;
13 c) a process for generating a traffic engineering
14 database; and
15 d) a traffic engineering database generated by the
16 processing for generating,
17 wherein the path determination facility is further
18 adapted to determine at least a part of a path based
19 on
20 i) contents of the traffic engineering
21 database, and
22 ii) at least one path constraint received from
23 the signaling facility,
24 wherein, if the path determination facility
25 cannot determine a complete constraint-based path to a
26 specified tail-end node, then the path determination
27 facility performs a constraint-based path determination
28 to a next node selected from a group of nodes consisting
29 of
30 - an area border node,
31 - an autonomous system gateway node,

32 - a node that can process one of the at least
33 one network path determination constraint
34 carried by the message which cannot be
35 evaluated by the present node,
36 - a specified loose-hop node, and
37 - a node to which constraint processing is
38 delegated,
39 to generate a partial path, and
40 the signaling facility forwards a message carrying the at
41 least one path constraint to an adjacent downstream node
42 on the partial path.

1 Claim 41 (original): The routing facility of claim 40
2 wherein the path is a label-switched path.

Claims 42-52 (canceled)

1 Claim 53 (previously presented): The method of claim 5,
2 wherein the node is an intermediary node, and wherein the
3 act of performing a constraint-based path determination
4 includes determining whether a link from the node to the
5 next node specified in a first portion of the path
6 satisfies the set of at least one constraint.

1 Claim 54 (previously presented): A method for
2 processing, by a node of a network, a message carrying at
3 least one network path determination constraint, the
4 method comprising:

5 a) performing a constraint-based path determination
6 to a next node to generate a partial path;
7 b) forwarding the message carrying the at least one
8 network path determination constraint to an adjacent
9 downstream node on the partial path, wherein the
10 node is an intermediary node, and wherein the act of
11 performing a constraint-based path determination
12 includes determining whether a link from the node to
13 the next node specified in the first portion of the
14 path satisfies the set of at least one constraint;
15 and
16 c) if the link from the first intermediary node to
17 the next node specified in a first portion of the
18 path is determined to satisfy the set of at least
19 one constraint, then transmitting the received
20 message to the next node.

1 Claim 55 (previously presented): A method for
2 processing, by a node of a network, a message carrying at
3 least one network path determination constraint, the
4 method comprising:
5 a) performing a constraint-based path determination
6 to a next node to generate a partial path;
7 b) forwarding the message carrying the at least one
8 network path determination constraint to an adjacent
9 downstream node on the partial path, wherein the
10 node is an intermediary node, and wherein the act of
11 performing a constraint-based path determination
12 includes determining whether a link from the node to
13 the next node specified in the first portion of the

14 path satisfies the set of at least one constraint;
15 and
16 c) if the link from the first intermediary node to
17 the next node specified in a first portion of the
18 path is determined not to satisfy the set of at
19 least one constraint, then transmitting an error
20 message back to the source node.

Claim 56 (canceled)

1 Claim 57 (previously presented): The computer-readable
2 storage medium of claim 35 wherein first operand
3 specifies a memory location in which a value for an
4 attribute of a network node or link is stored, and the
5 second operand represents a constraint value for the
6 attribute, and further comprising:
7 c) a code specifying an operation to be performed
8 on the first operand and second operand; and
9 d) a result portion specifying a memory location in
10 which a result of the operation performed on the
11 first operand and second operand is stored.

Claims 58 and 59 (canceled)

1 Claim 60 (previously presented): A network node
2 comprising:
3 a) a plurality of registers including attribute
4 registers, the attribute registers storing
5 attributes of links in the network; and

6 b) a machine-readable medium having stored thereon
7 at least one network path determination constraint
8 as an executable instruction, each executable
9 instruction including
10 i) a first operand pointer,
11 ii) a second operand pointer, and
12 iii) an operation code,
13 wherein at least one of the first and
14 second operand pointers points to one of the
15 attribute registers, and
16 wherein the executable instruction was received
17 in a message from another network node, and
18 wherein the machine-readable medium further stores
19 thereon a table including
20 i) a first entry representing a first
21 attribute of a node or link connected to the
22 node,
23 ii) a second entry representing an accumulated
24 value for a second attribute of a node or link
25 connected to the node, and
26 iii) a third entry storing a result of a
27 specified operation performed on one of the
28 first entry and the second entry.

1 Claim 61 (previously presented): A network node
2 comprising:
3 a) a plurality of registers including attribute
4 registers, the attribute registers storing
5 attributes of links in the network; and

6 b) a machine-readable medium having stored thereon
7 at least one network path determination constraint
8 as an executable instruction, each executable
9 instruction including
10 i) a first operand pointer,
11 ii) a second operand pointer, and
12 iii) an operation code,
13 wherein at least one of the first and
14 second operand pointers points to one of the
15 attribute registers, and
16 wherein the executable instruction was received
17 in a message from another network node, and
18 wherein the machine-readable medium further stores
19 thereon a memory data structure including
20 i) a first portion storing attributes of nodes
21 or links in the network,
22 ii) a second portion storing network-path
23 constraints, and
24 iii) a third portion storing instructions for
25 performing operations on the stored attributes
26 and the stored constraints; and further
27 comprising:
28 c) a processor for executing the instructions
29 stored in the third portion of memory and computing
30 a path in the network based on results of the
31 executed instructions.

Claim 62 (canceled)

1 Claim 63 (previously presented): The network node of
2 claim 6 wherein if constraint processing has been
3 delegated to another network element, then the path
4 determination facility further performs a
5 constraint-based path determination to the other network
6 element to which constraint processing has been delegated
7 to generate a partial path.

Claims 64-69 (canceled)

1 Claim 70 (currently amended): A method for processing, by
2 a node of a network, a message from another node of the
3 network, the message carrying at least one network path
4 determination constraint, the method comprising:
5 a) determining whether to delegate constraint
6 processing to another device; and
7 b) if it has been determined that constraint
8 processing has been delegated to another network
9 element, forwarding the message carrying the at least
10 one network path determination constraint to the other
11 device.

1 Claim 71 (previously presented): The method of claim 36
2 wherein each of the at least one network path determination
3 constraint is an executable instruction.

1 Claim 72 (previously presented): The method of claim 70
2 wherein each of the at least one network path determination
3 constraint is an executable instruction.

Claim 73-78 (canceled)

1 Claim 79 (previously presented): The method of claim 5,
2 wherein the program includes a plurality of executable
3 instructions.

1 Claim 80 (previously presented): The method of claim 6,
2 wherein the program includes a plurality of executable
3 instructions.

1 Claim 81 (previously presented): The method of claim 11,
2 wherein the program includes a plurality of executable
3 instructions.

1 Claim 82 (previously presented): The method of claim 37,
2 wherein the program includes a plurality of executable
3 instructions.

1 Claim 83 (previously presented): The method of claim 38,
2 wherein the program includes a plurality of executable
3 instructions.

1 Claim 84 (previously presented): The method of claim 39,
2 wherein the program includes a plurality of executable
3 instructions.